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Thoughts on Regulatory Requirements for CO_2 Injection

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Topics

- How should CO_2 be classified?
- What should we call the process of injecting CO_2?
- If I were building a regulatory program, what elements would I want to include?
- If carbon geosequestration becomes a large-scale reality, how can state, federal, and international agencies scale up to handle the tens of thousands of new injection wells?

What Is CO_2?

- Different properties and impacts depending on time, place, and application
  - Natural substance with negative impact on atmosphere and climate
  - Important substance/raw material for plant growth
  - Valuable aid to hydrocarbon production
  - Commodity for trading
  - Waste
  - Component of popular beverages

What is CO_2 - continued

- The legal and perception implications seem to be driving the way in which different groups are trying to characterize CO_2
- We should not try to be too clever about naming and defining activities
  - *The public is not stupid!*
  - *Attempts to disguise reality will not engender confidence*
- Any regulatory scheme that emphasizes the negative properties of CO_2 will impede society's ability to manage/store/sequester carbon

What Should We Call the Process for Injecting CO_2 Underground?

- Traditionally called “sequestration”
- More recent efforts, concerned with perception and legal implications, have shifted to the term “storage”
  - How long will the material be stored?
  - Does society have any serious intention to recover or reclaim the CO_2?
- How does injection for enhanced recovery equate to storage?
- I prefer the term “sequestration” or more specifically, “geosequestration” or “geological sequestration”

What Are Some Concerns About CO_2 Geologic Sequestration?

- Regulators and injectors have limited experience with CO_2 geologic sequestration. Challenges include:
  - Lower fluid density = greater buoyancy of injectate
  - CO_2 reacts with water to form acid
  - What other constituents will be acceptable in the CO_2 injectate?
  - Geochemical changes
    - *Could other chemicals be generated in the formations and in ground water as a result of CO_2 injection?*
  - Damaging effects on cement and metal
  - Keeping CO_2 in desired formations for a sustained time
    - *How much CO_2 escape is acceptable?*

What Should Be Part of a Regulatory Program for CO_2 Geosequestration?

- Siting
  - Geology of injection formation and overlying formations
  - Reservoir pressure profiles and other characteristics
  - Appropriate area of review (well bores, faults, or vertical conduits)
- Well construction
  - Strength and metallurgy of pipes, casing
  - Number of casing strings
  - Type and vertical extent of cement
  - Assurance of good cement bond
- Operations
  - Maximum injection pressure (above or below fracture pressure)
  - Injection rate and volume
  - Interactions between injectate, formations, and formation fluids
  - Injection for sequestration/storage vs. use for EOR

Additional Regulatory Issues for Geosequestration

- Monitoring
  - Mechanical integrity testing
  - How to monitor sequestration area
- Closure
  - Plugging and securing
  - Long term issues
  - Financial assurance
- Legal/Policy
  - Ownership interests in wells, pore spaces, and fluids
  - Long-term maintenance and liability
  - Length of time that CO_2 must be sequestered underground
  - Credit for CO_2 capture/removal from atmosphere

How Can Society Manage the Massive Scope of the Proposed CO_2 Geologic Sequestration?

- If society is serious about the benefits of removing CO_2 from the atmosphere, it must accept some potential costs/risks of placing that CO_2 somewhere
  - Education of the public will be critical to manage the vast misinformation that will circulate
    - *Start very soon with school children and let them become familiar with the issues, challenges, and options for solutions*
  - The public will become more focused on global warming and carbon control following the May 24 release of the new Al Gore movie “An Inconvenient Truth”

Regulatory Program Development

- Build on existing UIC program
  - Consider whether CO_2 injection wells can fit appropriately into existing well classes or whether new well class is needed
  - Provide for guidance and training to regulators with expected delegation of permitting authority from federal to state agencies
- Need to start out slowly and carefully, but be prepared to institute mechanisms to allow rapid permitting of large number of similar projects
- Recognize that the types of controls and requirements used when evaluating and permitting the first 10, 50, or 100 injection wells will not be practical or appropriate for a later time when hundreds to thousands of wells will be permitted per year
  - Example: permitting of coal bed methane wells in Powder River Basin